July 12, 1932. E. A. NELSON 1,867,229

METHOD OF MAKING CAP NUTS

Filed April 7, 1930

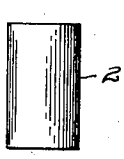


Fig. 1.

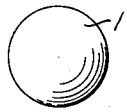


Fig. 3.

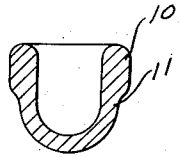


Fig. 5.

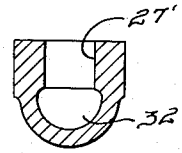


Fig. 7.

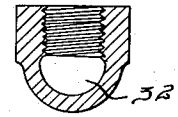


Fig. 9.



Fig. 2.

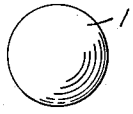


Fig. 4.

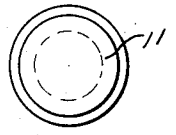


Fig. 6.

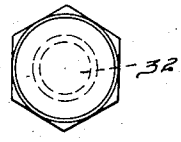


Fig. 8.

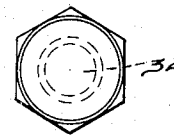


Fig. 10.

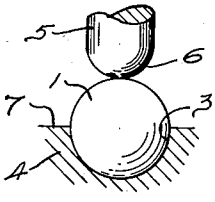


Fig. 11.

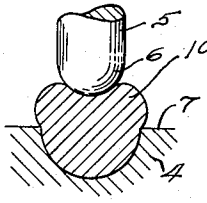


Fig. 12.

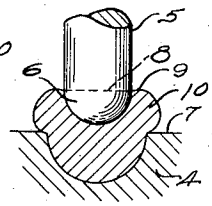


Fig. 13.

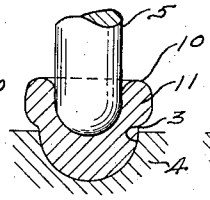


Fig. 14.

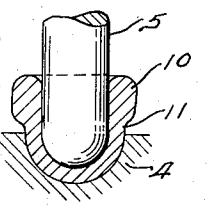


Fig. 15.

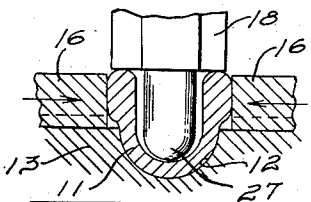


Fig. 16.

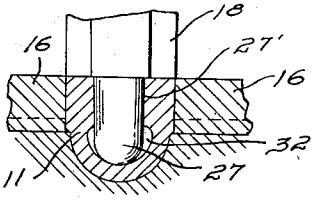


Fig. 17.

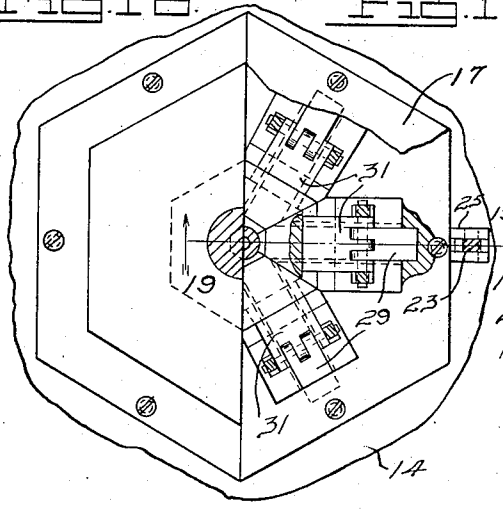


Fig. 18.

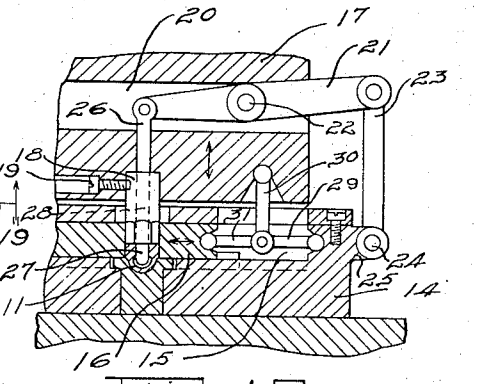


Fig. 19.

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Patented July 12, 1932

1,867,229

UNITED STATES PATENT OFFICE

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METHOD OF MAKING CAP NUTS

Application filed April 7, 1930. Serial No. 442,147.

This invention relates to an improved method and means for making cap nuts, particularly of the type which have a crown shape or semi-cylindrical blind end and are known as "acorn" nuts.

Heretofore, in making blind cap nuts of this kind it has been customary to first produce a blank either by forming a crown on one end of a piece of hexagonal stock in a screw machine or by die stamping a piece of cylindrical stock so as to form a solid crown or dome at one end thereof and a solid hexagonal part at the other end. The blank so formed is then hollowed out by a drilling operation and subsequently reamed to provide smooth internal surfaces and threads are ultimately cut on the inner walls of the blank by a tap.

Considerable time is required to produce cap nut blanks by the above method, a large percentage of the material used is wasted by drilling the blank to a substantial hollow condition and the percentage of waste is augmented materially when the dome shaped end of the blank is formed in a screw machine. After the threads are formed in the inner walls of the blank it is usually necessary to polish the exterior of the cap nuts in order to improve their appearance.

The main objects of this invention are to provide an improved method for making cap nuts or like hollow metallic units, in which method both the time and the stock required are materially reduced; to provide a method of this kind in which a hollow cap nut blank is formed by a punching operation so as to positively obviate wasting of stock during hollowing out of the blank; to provide an improved shaping method for forming a piece of ground polished stock into a hollow cap nut blank by a single operation without marring or otherwise disfiguring the polished surfaces of the stock which are ultimately located on the exterior of the blank; and to provide a method of this kind by which a quantity of stock of precisely the correct amount is worked toward one end of the blank to form an enlarged end portion, which may be formed to hexagonal or other uneven shape without producing flashes at the junction of the adjacent sides thereof.

Further objects of the invention are to provide an improved device for forming a portion of predetermined shape on the end of a cap nut blank and simultaneously squaring up the extremities of the end portion; to provide a device of this kind which is adapted to reduce the diameter of the outer end portion of the hollow interior of the blank with respect to the diameter of the inner end portion thereof so as to provide a recess or clearance space at the end of the blank in which chips may accumulate without clogging the path of the tap as the threads are formed, and into which the ends of the tap or the end of a bolt may extend.

An illustrative embodiment of my invention is shown in the accompanying drawing in which:

Fig. 1 is a side elevation of a piece of stock of one form which is used in my improved method.

Fig. 2 is an end view of the stock shown in Fig. 1.

Fig. 3 is an elevation of a sphere or ball into which the raw stock is initially formed.

Fig. 4 is a plan view of the sphere shown in Fig. 1.

Fig. 5 is a vertical section showing a blank as it appears after it is hollowed out by a punching operation.

Fig. 6 is a plan view of the blank shown in Fig. 5.

Fig. 7 is a vertical section showing the blank illustrated in Fig. 5 as it appears after the sides have been compressed into a polygonal shape and the adjacent end has been flattened.

Fig. 8 is a plan view of the blank shown in Fig. 7.

Fig. 9 is a section of a completed cap nut.

Fig. 10 is a plan view of the completed cap nut.

Fig. 11 is a diagrammatic view partly in section illustrating the initial arrangement of the spherical piece of stock with respect to the tool by which it is formed.

Fig. 12 is a view similar to Fig. 11 illus-

trating the initial stage of the punching operation.

Fig. 13 illustrates a progressed stage of the punching operation.

Fig. 14 illustrates a further progressed stage of the punching operation.

Fig. 15 illustrates a completed punching operation.

Fig. 16 is a diagrammatic view partly in section illustrating the initial arrangement of the completely punched blank with respect to the members of a machine by which a hexagonal head is formed thereon.

Fig. 17 is a view similar to Fig. 16 illustrating the completion of the head forming operation.

Fig. 18 is a plan view, partly in section, of the head forming device.

Fig. 19 is a vertical section taken on the line 19—19 of Fig. 18.

In forming cap nuts in accordance with my improved method spheres of metal or balls 1, shown in Figs. 3 and 4 are formed from a piece of stock 2 of suitable shape, preferably cylindrical, as shown in Figs. 1 and 2, and preferably by a forging operation with the aid of conventional dies and presses. The sphere is then ground to a desired diameter and its outer surface is polished in a conventional manner. Where the exterior surface of the blind end of the nut is to be spherical in shape, the polished ball is seated in a substantially hemispherical recess 3 formed in a die part 4 and a punch 5 having a substantially cylindrical end portion 6 is brought into contact with the top of the unseated portion of the sphere 1 as viewed in Fig. 11 and it is moved downwardly with respect to the metal sphere on a line which is substantially normal to the plane 7 of the die part in which the hemispherical recess 3 is formed. Where this non-spherical portion or end of the nut is to be hexagonal or any other desired shape, the shape of the recess 3 will, of course, be varied to conform therewith.

The downward movement of the punch 5 causes the rounded end 6 thereof to be inserted centrally into the sphere, spreading that portion thereof which is located above the plane 7 of the die part 4 as illustrated in Fig. 12. During further downward movement of the punch 5, the rounded end 6 thereof continues to spread or bulge the upper portion of the sphere outwardly until the diameter of the rounded end, indicated at 8, reaches the top or outer end 9 of the sphere, in other words, until the punch is embedded to its diameter in the sphere 1. At this stage of the operation the sphere has a substantial indentation as will be seen in Fig. 13 and it now begins to take on the form of a hollow blank.

During the above stages of the blank forming operation, the portion of the sphere which protrudes beyond the surface 7 of the die part 4 is spread outwardly by the rounded end 6 of the punch thereby crowding the metal and forming a periphereal bead 10, but upon continued insertion of the punch 5 into the material of the sphere no further spreading action occurs. Instead, the metal climbs or flows up the side of the punch as the latter is passed into the blank substantially without changing in diameter, and carries the bead 10 upwardly with it. The punch 5 is inserted until the center of curvature of the rounded end 6 thereof is substantially coincident with the center of curvature of the hemispherical recess 3 of the die part 4, as shown in Fig. 15.

The hollowed out blank 11 is then removed from the die part 4 and from the end of the punch 5 and placed in a correspondingly shaped recess 12 formed in a support 13 which is centrally located in a bed part 14 of a head forming punch press shown in Figs. 18 and 19. In the form shown, the punch press is adapted to form hexagonal heads on the beaded end 10 of the blank 11, but it is understood that polygonal heads having any desired number of sides, or smooth surfaced sides, may be formed by a similar machine.

The bed part 14 of the punch press is provided with 6 radially extending grooves 15 in which jaws 16 are slidably mounted. A vertically shiftable ram 17 is located above the bed 14 and is provided with a hammer 18 which registers with the outer end or top of the blank 11 and which is firmly held in place by a set screw 19. Formed in the ram 17 is a transverse passage 20 into which a rocker arm 21 extends and is pivoted to one end of a link 23 which is pivotally supported at 24 on a bracket 25 of the bed part 14 of the press.

Pivotally mounted on the inner end of the rocker arm 21 is a plunger or stem 26 having a mandrel 27 on its lower extremities which is adapted to extend into the interior of the blank 11. The mandrel 27 is slightly smaller in diameter than the internal diameter of the blank 11 and it extends through an axial passage 28 in the hammer 18.

A toggle member comprising pivotally connected links, 29, 30 and 31 is located in each of the transverse passages 15 of the bed part 14 and the outer end of the links 29, 30 and 31 are pivoted to the bed part 14, ram 17 and one of the jaws 16 respectively as shown in Fig. 19.

In operation of the head-forming punch press, the initial downward movement of the ram 17 causes the mandrel 27 to be inserted into the interior of the blank 11 and further downward movement of the ram spreads the links 29 and 31 of the toggle actuating members driving the jaws 16 inwardly against the bead 10 of the blank 11. This action forms flat planular sides on the beaded end of the blank 11 and compresses the metal thereof in-

wardly against the mandrel 27 thereby constricting the outer end portion 27′ of the central aperture of the blank and forming a recess 32 at the inner extremity of the central aperture.

The final downward movement of the ram 17 brings the hammer 18 into forcible contact with the top end of the blank 11 and flattens the same. When the ram 17 is moved upwardly the rocker arm 21 is rotated in a clockwise direction causing the stem 26 to be moved upwardly at a faster rate of speed than the upward movement of the ram. This action withdraws the mandrel 27 from the interior of the blank which normally tends to grip the sides of the mandrel 27 on which it has been compressed, the blank 11 being held against movement with the mandrel 27 by the lower end of the hammer 18.

The blank 11 is then removed from the support 13 and threads are cut on the inner walls of the constricted portion 27′ by a tap, the recess 32 at the inner end of the central aperture of the blank providing clearance to accommodate the chips which are formed during the tapping operation, and thereby prevents the clogging of the path of the tap and consequent liability of breakage of the tap. This recess also accommodates the end of a bolt, not shown, when the cap nut is in use.

The above operations are preferably formed upon the metal while the latter is cold so as to preserve the polish originally provided on the exterior of the sphere 1, but if desired, the above operations may be performed on heated metal. I have found that where the operation is performed on the cold metal, the original surface of the sphere or ball is carried through to the spherical portion of the completed article regardless of the deformation of the ball in the process of forming the nut, and when the ball is provided with a smooth polished surface, no polishing operation is necessary on the final product to make is presentable.

A sphere of a predetermined size is used on which a bead having precisely the correct amount of metal is formed by the above punching operation so as to obviate the formation of flashes at the adjacent faces of the hexagonal ends of the cap nut during the head forming and passage-constricting operation and to prevent waste of the material. With my improved method, all of the metal originally present in the sphere 1 with the exception of that portion which is removed during the tapping operation, remains in the blank and therefore the waste involved is substantially negligible. The resulting saving over similar nuts made in screw machines is enormous.

Although but one specific embodiment of this invention has been herein shown and described, it will be understood that numerous details of the construction shown may be altered or omitted without departing from the spirit of this invention as defined by the following claims.

What I claim is:

1. In the manufacture of cap nuts, the method of forming a blank which consists in supporting a piece of stock in a close fitting die part beyond which a portion of the stock extends and is unrestricted, inserting a punch centrally through the unrestricted portion of said stock and into the portion thereof which is seated in said die part so as to laterally spread the unrestricted portion of said stock and flow a portion of the restricted portion thereof toward said unrestricted portion.

2. In the manufacture of cap nuts, the method of forming a blank which consists in placing a metal sphere in a recess of predetermined shape in a die part of materially smaller volume than the sphere beyond which a portion of said sphere extends and is unrestrained, inserting a punch through the unrestrained end of said sphere and into the die seated end thereof, thereby spreading the unrestrained end thereof while insuring conformity of the restrained portion of said sphere to the shape of said recess, and shaping the spread end to a predetermined contour.

3. In the manufacture of cap nuts, the method of making a blank which consists in forming a piece of stock substantially into a sphere, grinding said sphere, placing the latter in a correspondingly shaped recess in a die part beyond which a portion of said sphere extends and is unrestrained, and inserting a punch through the unrestrained end of said sphere and into the die seated end thereof, thereby hollowing out said sphere and spreading the unrestrained end thereof while preserving the outer shape of said die seated end.

4. In the manufacture of cap nuts, the method of making a blank which consists in forming a piece of stock substantially into a sphere, grinding said sphere, placing the latter in a correspondingly shaped recess in a die part beyond which a portion of said sphere extends and is unrestrained, inserting a punch through the unrestrained end of said sphere and into the die seated end thereof, thereby hollowing out said sphere and spreading the unrestrained end thereof while preserving the outer shape of said die seated end, and forming a polygonal head on the spread end.

5. In the manufacture of cap nuts the method of making a blank which consists in forming a piece of stock substantially into a sphere, grinding and polishing the surface of said sphere, placing the latter in a frusto-spherical recess of a die part, inserting a punch centrally into said sphere from the outer end thereof, so as to hollow out said

blank while preserving the polished external surface.

6. In the manufacture of cap nuts, the method of forming a blank which consists in supporting a piece of stock in a recess of a die part, inserting a punch into said piece of stock so as to simultaneously hollow out the latter and spread the material thereof adjacent the open end of said recess, placing a mandrel of smaller diameter than said punch in the depression formed thereby, and ramming the material of said spreaded end portion inwardly against said mandrel so as to form a cylindrical thread receiving constriction in said depression and then threading the constriction.

7. In the manufacture of cap nuts having closed crowns and heads of greater diameter than the crowns, the method of forming a blank which consists in supporting a piece of stock in a recess of a die part, inserting a punch into the said piece of stock so as to simultaneously hollow out the latter and spread the material thereof adjacent the open end of said recess to an external diameter corresponding to that of the head, placing a mandrel of smaller diameter than said punch in the depression formed thereby, and ramming the material at said spreaded end inwardly from respectively opposite sides so as to simultaneously constrict the outer end of said depression and form a polygonal head at said spreaded end.

8. The method of manufacturing cap nuts which consists in seating only one end of a piece of metal stock in a die part, inserting a punch into the unseated end of said stock so as to hollow out the latter and spread the unseated end thereof, placing a mandrel of smaller diameter than said punch in the depression formed thereby, forming a constriction in said depression and a head on said cap nut by compressing the unseated portion of said stock inwardly, and threading the inner walls of said depression at the constricted portion thereof.

9. The method of manufacturing cap nuts having a substantially semi-cylindrical blind end which consists in seating a part of a spherical piece of stock in a substantially semi-spherical recess formed in a die part and having a curvature corresponding with the curvature of said stock, inserting a punch into the unseated end of said stock, placing a mandrel in the depression formed by said punch, compressing the metal at the unseated end of said stock inwardly from respectively opposite sides so as to form a constriction in said depression, and tapping said depression at the constricted portion thereof.

10. The method of manufacturing cap nuts having a substantially crown shaped blind end, which consists in seating a crown shaped end portion of a piece of stock in a corresponding shaped recess in a die part, inserting a punch into the unseated end of said stock, placing a mandrel in the depression formed by said punch, compressing the unseated end of said stock laterally from respectively opposite directions to form a polygonal head and longitudinally to form a flat extremity thereon, and tapping said depression at the constricted portion thereof.

11. A method of forming a cup-like portion comprising a portion approximating a tube in shape and a portion having an approximately spherical surface closing the end of the first portion which comprises forming a solid blank to have an approximately spherical contour and having a portion of the same radius as the radius of the closed surface disposing the latter portion in a cup of the same size and shape but leaving the remainder of the blank free of confining surfaces and forcing a plunger having a rounded end against the blank to force the material to flow axially of the plunger to provide the tubular portion and maintaining the shape of the portion in the cup the shape of the tubular portion being due solely to the action of the plunger and the outer surface of the portion being free during the shaping operation.

12. A method of forming cap nuts having crown portions and polygonal heads which comprises forcing a punch having a cylindrical main body portion into a spherical blank which is supported in a cup-like die of a shape conforming to the crown and of materially lesser volume than the blank to cause the metal of the blank to flow along the punch and then to bulge laterally beyond the cup to provide an enlarged tubular head and subsequently radially compressing the head to provide plain sides thereupon.

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